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(71) Applicant (*for all designated States except US*): DELLE  
VEDOVE LEVIGATRICI SPA [IT/IT]; Viale Treviso,  
13/a, I-33170 Pordenone (IT).

(72) Inventor; and

(75) Inventor/Applicant (*for US only*): DELLE VEDOVE,  
Gaetano [IT/IT]; Piazzetta Ottoboni, 4, I-33170 Pordenone  
(IT).

(74) Agent: PETRAZ, Gilberto; GLP Srl, Piazzale Cavedalis,  
6/2, I-33100 Udine (IT).

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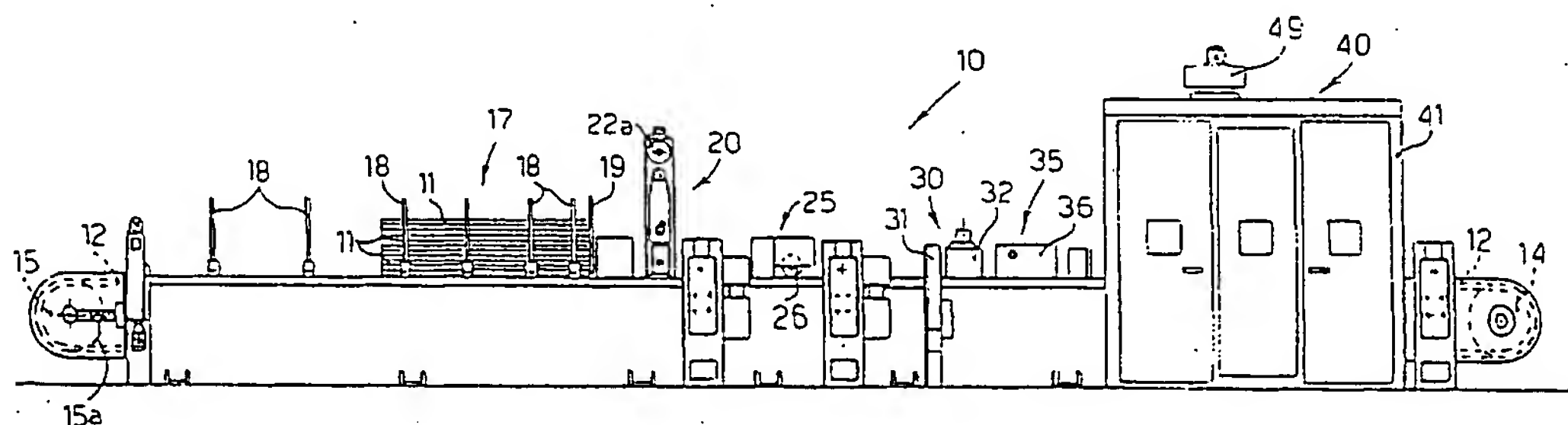
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(54) Title: APPARATUS AND METHOD FOR PAINTING OBJECTS SUCH AS PROFILES, PANELS OR SUCHLIKE



(57) Abstract: Apparatus (10) and method for painting objects (11) equipped with a painting head (35) to paint the objects (11), and a movement member (12) to move the objects (11) through the painting head (35). The apparatus (10) comprises working members (20, 25) arranged upstream and in line with the painting head (35) to perform a treatment on the objects (11) before they are introduced into the painting head (35), and a drying member (40) arranged downstream and in line with the painting head (35) in order to dry the objects (11) after they have been painted.

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"APPARATUS AND METHOD FOR PAINTING OBJECTS SUCH AS  
PROFILES, PANELS OR SUCHLIKE"

\* \* \* \* \*

FIELD OF THE INVENTION

5       The present invention concerns an apparatus for  
painting one or more surfaces of objects such as profiles,  
panels, strips or suchlike, made of any material, such as  
wood, metal, plastic material or other. The apparatus is  
particularly but not exclusively indicated for painting  
10 short pieces of less than 1 m, as little as 5 cm,  
advantageously from 10 cm to 50 cm. The apparatus comprises  
at least a painting station, or head, upstream of which  
possible loading/feeding means and means to perform at  
least one treatment on said objects are arranged, and  
15 downstream of which drying means are arranged to dry the  
paint applied. The apparatus also comprises movement means  
able to move the objects to be worked from the loading  
position defined by the loading means to the outlet from  
the drying means, through all the work stations of the  
20 apparatus.

The present invention also concerns the method for  
painting one or more surfaces of said objects.

BACKGROUND OF THE INVENTION

It is known that in order to make, paint and finish  
25 profile elements, panels, strips or suchlike, such as for  
example those used to make frames, furnishing components or  
otherwise, various types of machine are used, each with  
specific operating functions.

In fact, in shaping operations or in operations for  
30 finishing the size, wherein the transverse section of the  
profile is defined, machine tools are normally used that  
smooth and mill the various surfaces of the profile until  
the definitive shape is obtained. A subsequent step to the

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shaping operations is normally the painting step that is achieved by means of suitable painting stations or heads, for example like the one described in the patent application for an industrial invention filed by the present Applicant on 25 February 2002 under number UD2002A000045.

Finally, after painting, the shaped and painted profiles are inserted into a drying furnace in which the paint is dried and attached to the surfaces of the piece.

10 In the state of the art, all these working steps are normally done on different machines, arranged separate from each other, often in different zones or sections of the plant. This disadvantage entails the need to transfer the semi-worked profiles from one place to another, using  
15 intermediate conveyor belts or other means of transport such as trolleys or suchlike. Apart from increasing the production times, this leads to an increase in the production costs, in the structural and operating costs and an increased use of manpower.

20 Moreover, since these operations are not done in line, it is often necessary to temporarily store the semi-worked products to be worked, which takes up a large amount of space.

Another disadvantage is that the machines, being  
25 separated from each other, occupy large spaces and do not guarantee a perfect synchronism and coordination of their operating parts, thus leading to possible working errors.

These disadvantages are particularly troublesome when the operations are made on short pieces, for example with a  
30 length of less than one meter.

Applicant has devised and embodied the present invention to overcome these shortcomings of the state of the art, and to obtain other advantages.

## SUMMARY OF THE INVENTION

The present invention is set forth and characterized essentially in the main claims, while the dependent claims describe other innovative characteristics of the invention.

5 One purpose of the present invention is to achieve an apparatus for painting objects such as profiles, panels, strips or suchlike, which guarantees an optimum coupling and synchronism of the operating parts of the various machines, together with a rational occupation of the spaces  
10 and with a reduction in the dead times between one operation and the other.

Another purpose of the present invention is to achieve an apparatus for painting which does not need to transfer, and require the relative equipment therefore, the semi-  
15 worked products from one machine to the other, thus achieving a considerable reduction in installation costs and operating costs.

Another purpose is to achieve an apparatus that can efficiently work short pieces too, that is, with lengths of  
20 less than one meter, without entailing disadvantages in transport and coordination of the operating parts of the various machines.

In accordance with these purposes, an apparatus for painting objects such as profiles, panels, strips or  
25 suchlike, according to the present invention, comprises at least a painting station, or head, to paint the objects, working means arranged upstream of the painting head and able to perform at least one treatment on the objects, drying means arranged downstream of the painting head and  
30 able to dry the objects after they have been painted.

The apparatus also comprises integrated movement means to move the objects from a position wherein the working means are present to a position downstream of the drying

means.

According to a variant, the apparatus according to the invention comprises loading means arranged upstream of the working means, to load the objects onto the integrated  
5 movement means.

With the apparatus according to the invention it is possible to subject the objects to all the working and painting steps, and also to the drying step, in line and on a single apparatus, without needing to use transport  
10 devices to transfer the objects from one operating machine to the other, and maintaining the relative operating parts in constant synchronism and correct coordination, so that working errors can be considerably limited.

#### BRIEF DESCRIPTION OF THE DRAWINGS

15 These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example, with reference to the attached drawings wherein:

- fig. 1 shows a lateral view of the apparatus for  
20 painting according to the present invention;
- fig. 2 shows a view from above of the apparatus in fig. 1;
- fig 3 shows an enlarged detail of fig. 1;
- fig. 4 shows an enlarged detail of fig. 1;
- 25 - fig. 5 shows an enlarged section of a detail in fig. 1.

#### DETAILED DESCRIPTION OF A PREFERENTIAL FORM OF EMBODIMENT OF THE INVENTION

With reference to fig. 1, an apparatus 10, according to the present invention, for painting objects 11, in this  
30 case a wooden profile to make frames, comprises a conveyor belt 12, a loading station 17, a vertical smoothing station 20, a lateral smoothing station 25, a cleaning station 30, a painting station 35 and a drying station 40.



The conveyor belt 12 is arranged below the work stations and determines the plane on which the profiles 11 to be worked move and advance. The belt 12 is substantially annular in shape and consists of a plurality of flexible  
5 links 13 ringed together.

The belt 12 is moved by a pulley 14 arranged downstream of the drying station 40 and driven by a corresponding drive member 14a, and is kept under tension  
10 by a driven wheel 15 arranged upstream of the loading station 17 and provided with a chain tensioning device 15a, of a known type and therefore not shown in detail.

On the links 13, at a set pitch according to the length of the profile 11, transport blocks 16 are assembled with a height lower than that of the profile 11 and able to  
15 thrust the latter from behind from the loading station 17 as far as beyond the drying station 40.

The loading station 17 (fig. 3) comprises a plurality of lateral containing rods 18 arranged so that the profiles 11 to be worked can be stacked orderly above the conveyor  
20 belt 12, and a front plate 19 arranged at an adjustable height from the belt 12 so as to allow only one profile 11 to pass, so that when one of the transport blocks 16 of the belt 12 comes into contact with the pile of profiles 11, it makes only the last one translate.

25 Moreover, the lateral rods 18 can be varied in their inclination so as to allow any type of profile 11 to be loaded and stacked. The profiles 11 can also be less than 1 m in size, as little as about 5 cm, advantageously from 10 cm to 50 cm.

30 The vertical smoothing station 20 comprises an abrasive belt 21, moved above by a pulley 22, driven by a corresponding drive member 22a, and tensioned below by two belt tensioning wheels 23. Between the two belt tensioning

wheels 23 there is a pressure element 24 consisting of a linear actuator 24a. A counter-shape 24b is associated with the shaft of the linear actuator 24a, bearing the negative shape of the upper surface of the profile 11. The pressure  
5 element 24 is able to selectively take the abrasive belt 21 into contact with the upper surface of the profile 11.

The vertical smoothing station 20 can also be adjusted in height and/or inclined with respect to the plane on which the profile 11 moves, according to the size of the  
10 latter.

The lateral smoothing station 25 (fig. 2) comprises in this case three grinding wheels 26 arranged alternately and laterally with respect to the conveyor belt 12. Each grinding wheel 26 is shaped so as to define the profile of  
15 the lateral surfaces of the profile 11 and is driven by respective drive members 27.

The grinding wheels 26 are also adjustable in height and their distance from the belt 12 is selectively variable, according to the size of the profile 11 to be  
20 worked.

Downstream of the lateral smoothing station 25 a cleaning station 30 is arranged, comprising at least a de-ionizing bridge 31 and a blowing member 32 provided with an aspirator.

25 The de-ionizing bridge 31 is able to remove the charges of ions from the profile 11, so as to cancel the electrostatics which keep the chips, caused by the smoothing performed, retained on the profile 11, and to encourage the cleaning action performed by the blowing  
30 member/aspirator 32. In this way, the perfect cleaning of the worked surfaces of the profile 11 is guaranteed, so that, in the subsequent painting step, no imperfections remain under the layer of paint applied, thus degrading the

quality of the final product.

According to a variant, instead of the blowing member/aspirator 32 a device is provided with rotary brushes able to clean the three worked surfaces of the profile 11.

The painting station 35 (fig. 4), in this case, is of the type described in the patent application for an industrial invention UD2002A000045, which the present Applicant filed on 25 February 2002, and comprises a container 36 arranged astride the conveyor belt 12 and having an inlet aperture 37 and an outlet aperture 38, on opposite sides and aligned with each other, through which the profile 11 is made to pass.

Inside the container 36, in a continuous cycle, paint is introduced through a pipe 36a, and air is sucked out through a pump 36b. The paint is taken from a tank 36c, while the air, entering through the outlet aperture 38, mixes with the paint and is thus sucked towards the outside of the container 36.

The painting station 35 also comprises a closure element 39 inserted in the inlet aperture 37 and movable axially to move closer to/away from the outlet aperture 38. The closure element 39 is shaped like the inlet aperture 37 on the outside, and on the inside like the profile 11 to be painted, so that, in particular types of profile 11, the paint also covers the head and tail of the latter.

The drying station 40 (fig. 5) comprises a cabin 41 arranged astride the conveyor belt 12, inside which a plurality of pairs of drying lamps are arranged, to be more exact, two first lateral lamps 43, two second lateral lamps 44, opposite the first, and two upper lamps 45.

The two first lateral lamps 43 are able to dry mainly a lateral surface of the profile 11, the two lateral lamps



44 are able to dry mainly the surface opposite the one dried by the first two lamps 43, while the two upper lamps 45 are able to dry mainly the upper surface of the profile 11.

5       The drying station 40 also comprises, on the upper part of the cabin 41, a ventilation and aspiration device 49 able to continuously ventilate and suck in the fumes caused by the drying of the paints applied to the profile 11.

10       In correspondence with the zone of action of the first two lateral lamps 43, on the opposite side with respect to the lamps 43 and in proximity with the conveyor belt 12, a first guide bar 46 is provided, able to retain the profile 11 on one side in order to keep it at a substantially  
15 constant distance from the lamps 43, so that the action of the latter does not cause an inconstant drying of the paint, the formation of bubbles, or sudden combustion.

      The first guide bar 46 achieves this retention by means of a plurality of holes, not shown in the drawings,  
20 arranged longitudinally to the bar 46 and through which suction is performed which keeps the piece adherent through depression.

      In correspondence with the second lateral lamps 44 a second guide bar 47 is provided, arranged on the opposite  
25 side with respect to the lamps 44 and in proximity with the conveyor belt 12 and having substantially the same functions and the same functioning as the first guide bar 46.

      The apparatus 10 also comprises, arranged in set  
30 zones, sensor elements, of a conventional type and not shown in the drawings, able to activate in coordination the various components of the apparatus 10 by means of a central control and command unit 50.

The command and control unit 50 is able to receive the data supplied by the sensor elements and, according to a processor 51, for example of a PLC type or otherwise, commands the various drive members so that the profile 11 is subjected to the various operations.

The apparatus 10 as described heretofore functions as follows.

First a pile of profiles 11 is stacked up, even with a size less than a meter, inside the lateral rods 18, and the drive member 14a is driven so as to start the belt 12 moving.

When one of the blocks 16 is in contact with the rear part of the lowest profile 11, the latter is transported towards the vertical smoothing station 20 wherein the shape of its upper surface is finished, or defined.

Subsequently, the profile 11 is translated towards the lateral smoothing station, wherein the grinding wheels 26 finish, or define, the lateral surfaces of the profile 11.

The continuous movement of the conveyor belt 12 takes the profile 11 inside the painting station 35, wherein paint is applied to the lateral surfaces and the upper surface.

At outlet from the painting station 35, the profile 11 is translated to the drying station 40 wherein the guide bar 46 retains the profile 11 on one side, while the lamps 43 dry the opposite surface. In the same way, but on opposite surfaces, the profile 11 is retained by the guide bar 47 and dried by the lamps 44. The upper surface of the profile 11 is dried, as we said, by means of the upper lamps 45, after which the profile 11 exits from the cabin 41 and is picked up, manually or automatically, to be subjected to other treatments or to be stored.

It is clear, however, that modifications and/or

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additions of parts can be made to the apparatus 10 as described heretofore, without departing from the field and scope of the present invention.

It is also clear that, although the present invention  
5 has been described with reference to specific examples, a person of skill in the field shall certainly be able to achieve many other equivalent forms of apparatus and method for painting objects such as profiles, panels or suchlike, all of which shall come within the field and scope of the  
10 present invention.

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## CLAIMS

1. Apparatus for painting objects (11) comprising at least a painting head (35) able to paint said objects (11), and movement means (12) able to move said objects (11) through  
5 said painting head (35), characterized in that it comprises working means (20, 25) arranged upstream and in line with said painting head (35) able to perform at least one treatment on said objects (11) before they are introduced into said painting head (35), and drying means (40)  
10 arranged downstream and in line with said painting head (35) able to dry said objects (11) after they have been painted.
2. Apparatus as in claim 1, characterized in that it comprises loading means (17) arranged upstream of said  
15 working means (20, 25), and able to load said objects (11) onto said movement means (12).
3. Apparatus as in claim 2, characterized in that said movement means (12) are able to move said objects (11) from said loading means (17) to beyond said drying means (40).
- 20 4. Apparatus as in claim 1, characterized in that said working means comprise a first smoothing station (20) able to work at least the upper surface of said objects (11), and a second smoothing station (25) able to work at least the lateral surface of said objects (11).
- 25 5. Apparatus as in claim 4, characterized in that said first smoothing station (20) can be adjusted in height and/or inclined with respect to the plane on which said objects (11) slide, according to the size of said objects (11), and comprises at least an abrasive element (21),  
30 moved by a pulley (22), driven in turn by a corresponding drive member (22a).
6. Apparatus as in claim 5, characterized in that said abrasive element comprises an annular belt (21) tensioned

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by two belt tensioning elements (23) between which a pressure element (24) is arranged, able to selectively take said annular belt (21) into contact with said upper surface of said objects (11).

5 7. Apparatus as in claim 6, characterized in that said pressure element (24) comprises a linear actuator (24a) with whose shaft a counter-shape (24b) is associated, bearing the negative shape of the upper surface of said objects (11).

10 8. Apparatus as in claim 4, characterized in that said second smoothing station (25) comprises a plurality of abrasive disks (26) arranged alternately and laterally with respect to said movement means (12), each of said abrasive disks (26) being shaped so as to define the profile of the  
15 lateral surfaces of said objects (11), and being driven by respective drive members (27).

9. Apparatus as in claim 8, characterized in that the distance of said abrasive disks (26) from said movement means (12) is selectively variable according to the size of  
20 said objects (11).

10. Apparatus as in claim 1, characterized in that said drying means (40) comprise a cabin (41) arranged astride said movement means (12), a plurality of pairs of drying elements (43, 44, 45) being arranged inside said cabin  
25 (41).

11. Apparatus as in claim 10, characterized in that said pairs of drying elements comprise in series two first lateral lamps (43) able to dry at least a lateral surface of said objects (11), two second lateral lamps (44),  
30 opposite the first and able to dry at least a lateral surface of said objects (11), and two upper lamps (45) able to dry at least an upper surface of said objects (11).

12. Apparatus as in claim 10, characterized in that said



drying means (40) comprise, on the upper part of said cabin (41), a suction device (49) able to continuously suck in the fumes due to the drying of the paints applied to said objects (11).

5 13. Apparatus as in claim 11, characterized in that in correspondence with the zone of action of said first lateral lamps (43), on the opposite side with respect thereto and in proximity with said movement means (12), a first guide bar (46) is provided able to retain said  
10 objects (11) on one side in order to keep them at a substantially constant distance from said first lateral lamps (43).

14. Apparatus as in claim 13, characterized in that the retention by said first guide bar (46) of said objects (11)  
15 is achieved by means of suction performed by a plurality of holes arranged longitudinally with respect to said first guide bar (46).

15. Apparatus as in claim 11, characterized in that in correspondence with the zone of action of said second  
20 lateral lamps (44), on the opposite side with respect thereto and in proximity with said movement means (12), a second guide bar (47) is provided able to retain said objects (11) on one side in order to keep them at a substantially constant distance from said second lateral  
25 lamps (44).

16. Apparatus as in claim 15, characterized in that the retention by said second guide bar (47) of said objects (11) is achieved by means of suction performed by a plurality of holes arranged longitudinally with respect to  
30 said second guide bar (47).

17. Apparatus as in claim 1, characterized in that said painting head (35) comprises a containment element (36) arranged astride said movement means (12) and having, on

opposite sides and aligned with each other, at least an inlet aperture (37) and at least an outlet aperture (38), through which said objects (11) are able to pass, a closure element (39) being inserted in said inlet aperture (37) and  
5 being movable axially in order to move closer to/away from said outlet aperture (38).

18. Apparatus as in claim 3, characterized in that said movement means comprise a conveyor belt (12) with a substantially annular shape and consisting substantially of  
10 a plurality of flexible elements (13) ringed together, said conveyor belt (12) being moved by a pulley (14) driven by a corresponding drive member (14a) and arranged downstream of said drying means (40), and being held under tension by a driven wheel (15) arranged upstream of said loading means  
15 (17) and provided with a chain tensioning device (15a).

19. Apparatus as in claim 18, characterized in that each of said flexible elements (13) is suitable to support transport blocks (16), which have a height less than that of said objects (11) and are able to thrust said objects  
20 (11) from behind.

20. Apparatus as in claim 2, characterized in that said loading means (17) comprise a plurality of lateral containing rods (18) arranged so that said objects (11) can be stacked orderly above said movement means (12), and a  
25 front plate (19) arranged at an adjustable height from said movement means (12) such as to allow the movement of only one of said objects (11).

21. Apparatus as in claim 1, characterized in that between said working means (20, 25) and said painting head (35)  
30 cleaning means (30) are provided able to remove the impurities left on the surfaces of said objects (11) after said objects (11) have passed through said working means (20, 25).

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22. Apparatus as in claim 21, characterized in that said cleaning means (30) comprise at least a de-ionizing element (31), able to eliminate the electrostatic charges from said objects (11), and blowing/suction means (32) able to blow  
5 and suck in said impurities left.

23. Apparatus as in any claim hereinbefore, characterized in that it is also able to work objects (11) with a size of about 1 m to about 5 cm, advantageously from about 10 cm to about 50 cm.

10 24. Method for painting objects (11) comprising at least a step of working (20, 25) said objects (11) which precedes said painting, at least a painting step wherein said objects (11) are painted, and at least a drying step (40), subsequent to said painting, wherein the paint applied on  
15 said objects (11) is dried, characterized in that said steps of working, painting and drying are performed in line on a single apparatus (10), and in that said objects (11) are moved by means of movement means (12) from said working step to said drying step through relative stations (20, 25,  
20 35) which perform said working, painting and drying steps.

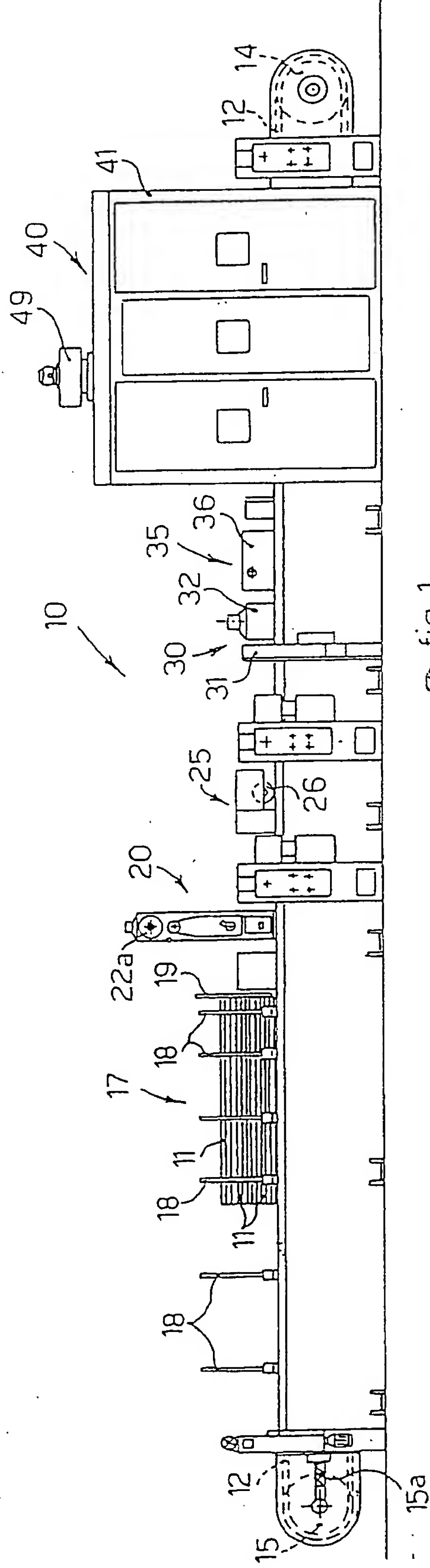


fig.1

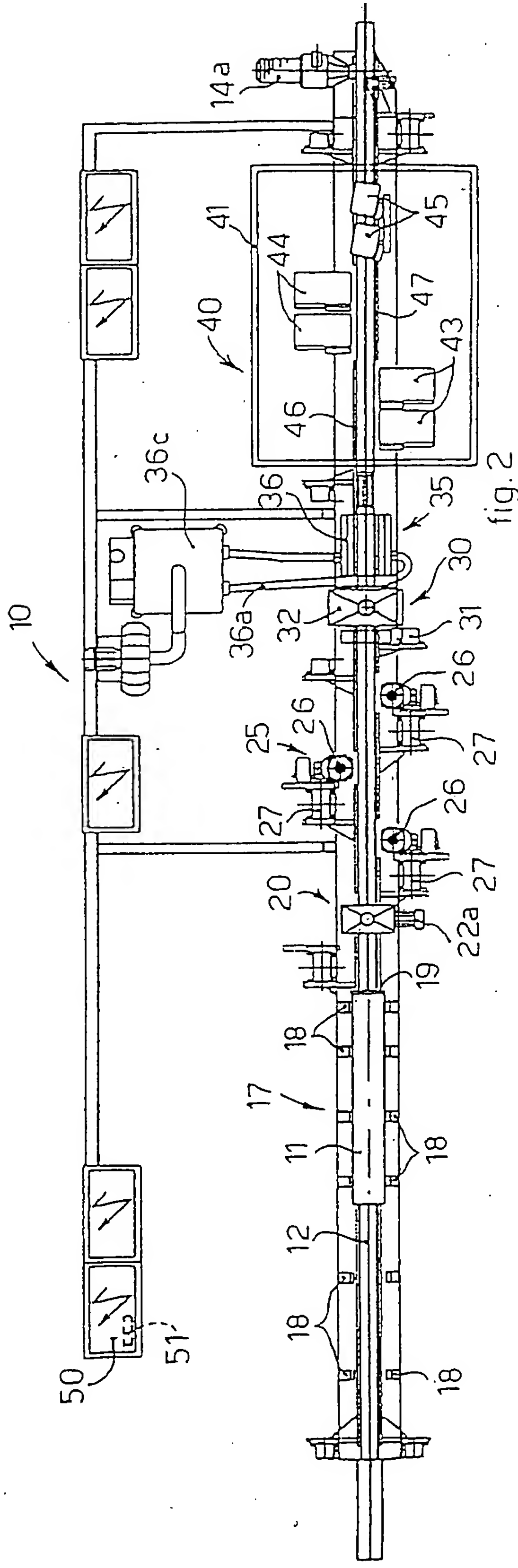


fig.2

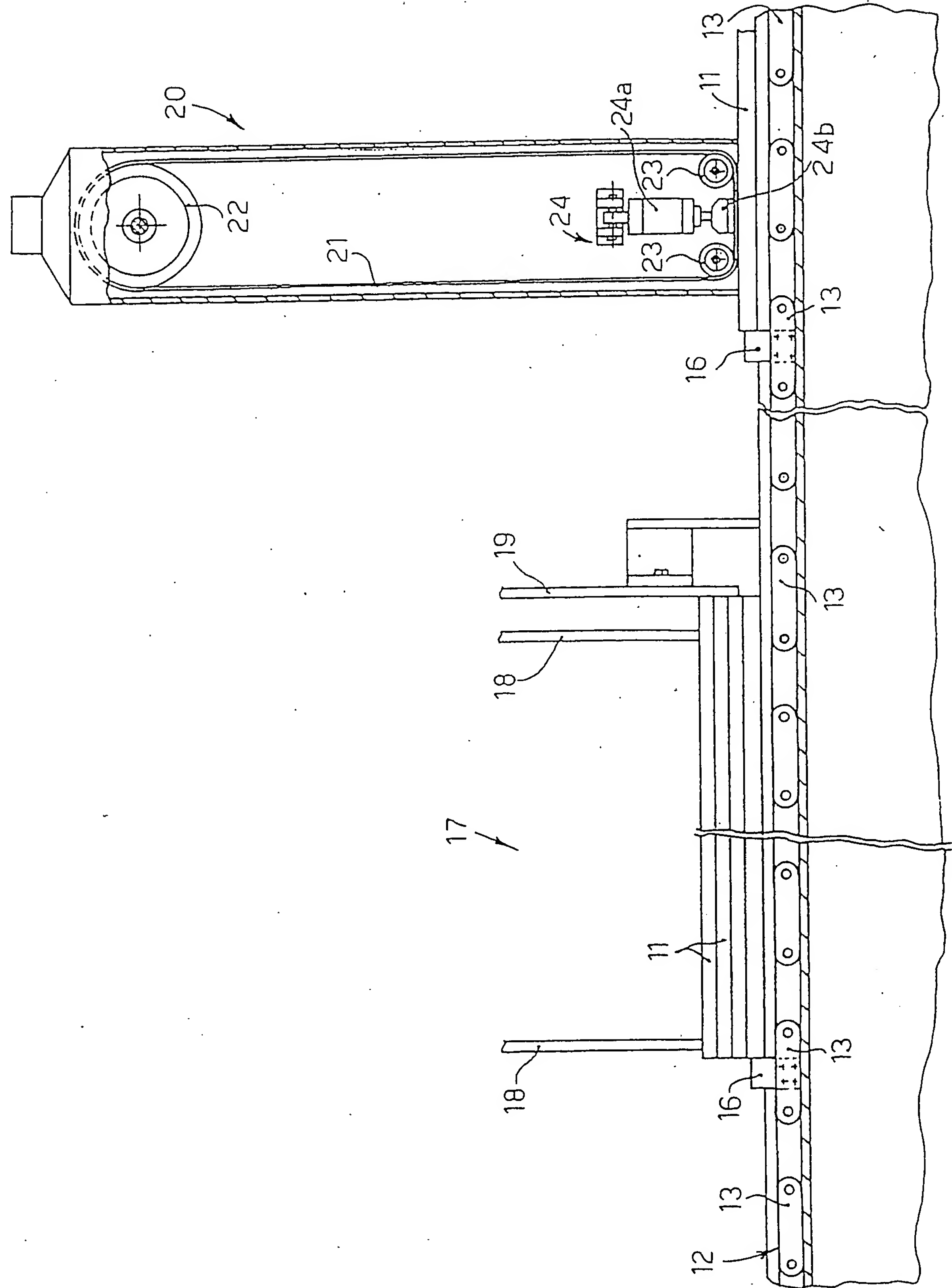


fig. 3



3 / 4

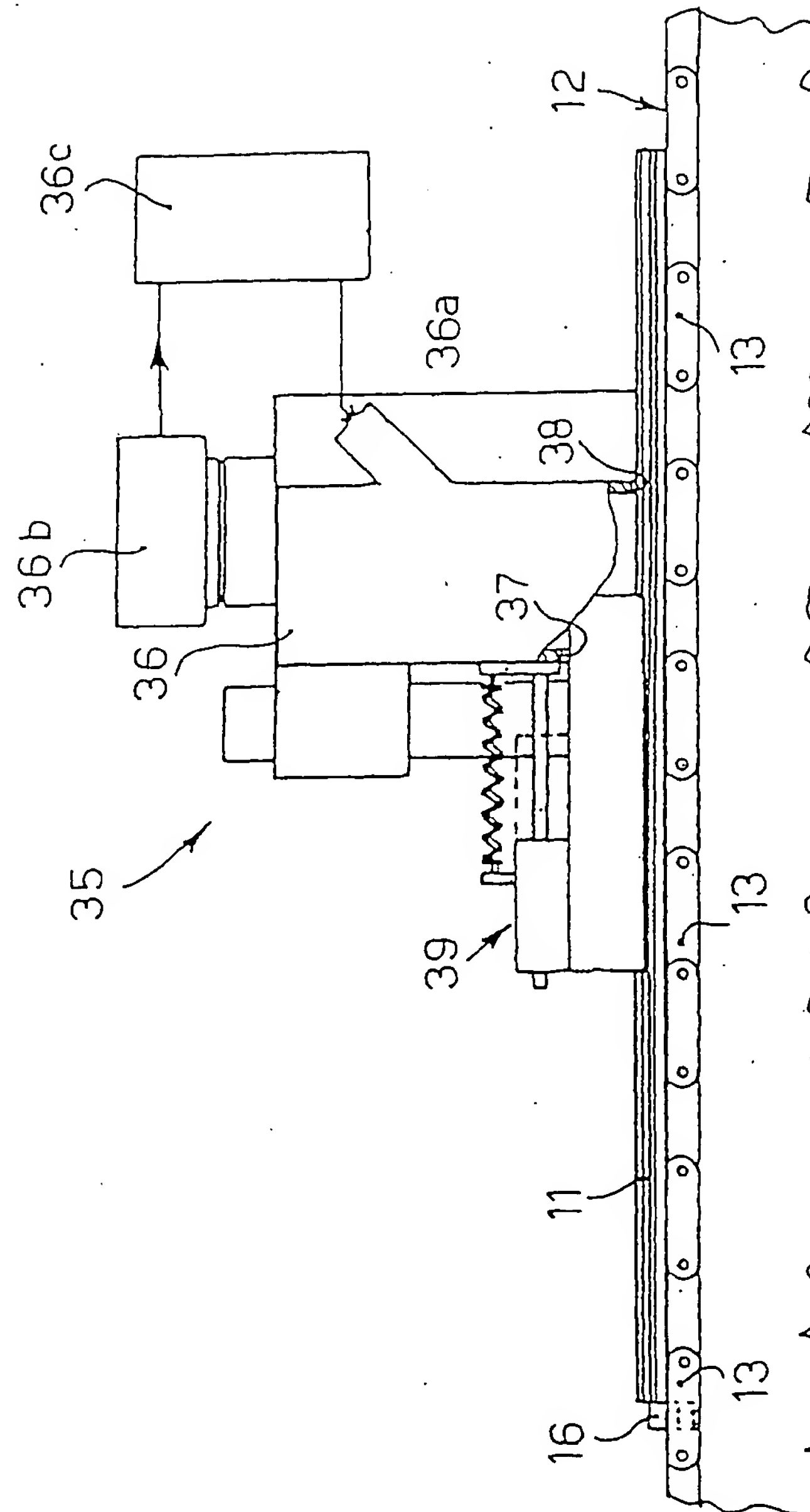


fig. 4

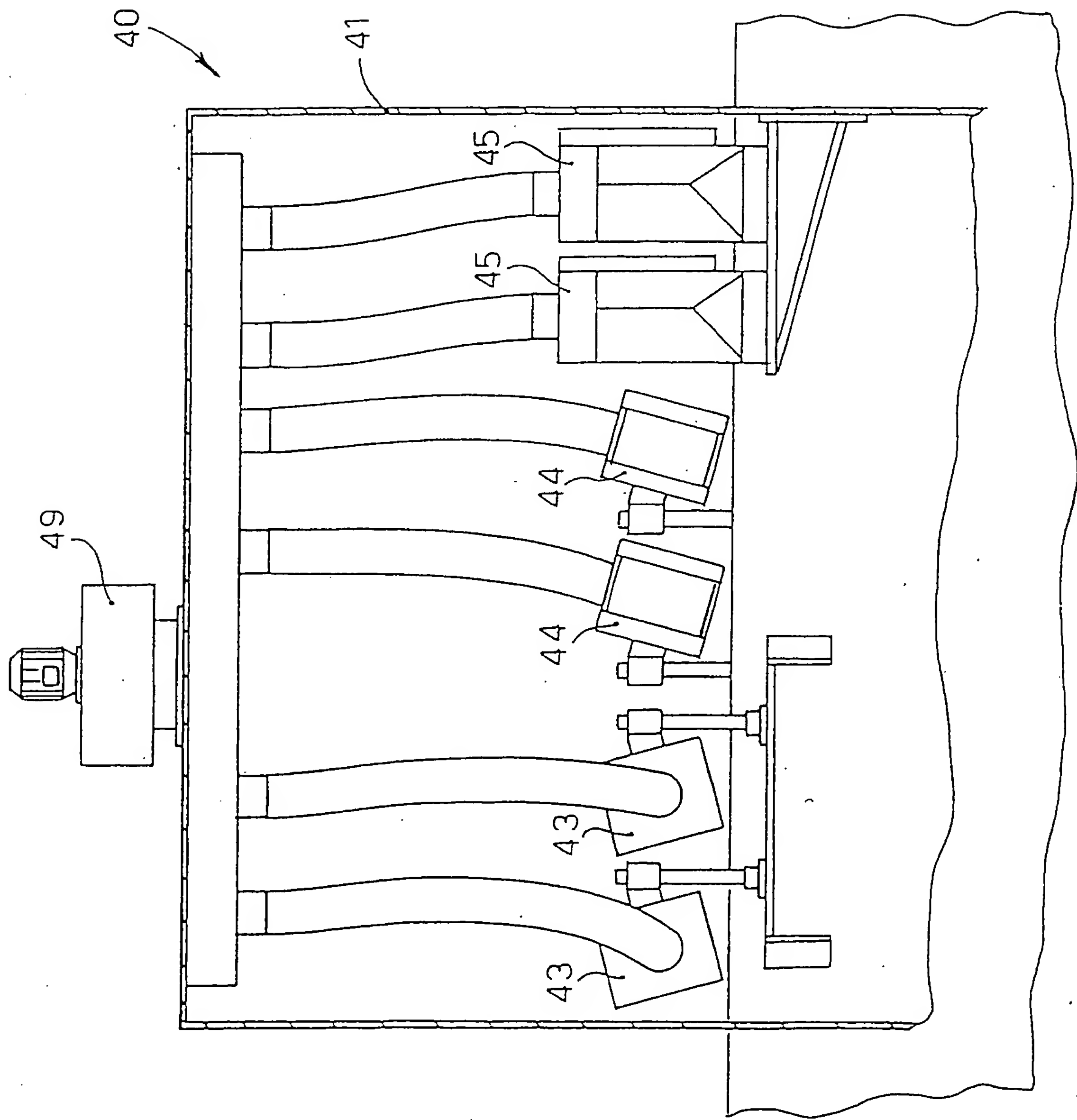


fig. 5

## INTERNATIONAL SEARCH REPORT

Internal Application No  
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## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B05C9/10 B05C9/12 B24B21/06 B24B7/28 B05B13/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 334 231 A (CAFFREY PETER ;TUIE GERARD (IE)) 18 August 1999 (1999-08-18) the whole document	1-3,10, 24
Y	---	4-7
X	US 4 390 564 A (KIMBLE ALVIN J) 28 June 1983 (1983-06-28) column 2, line 33 -column 4, line 5; figures 1,2	1-3,10, 24
A	---	4-6,11, 17
X	US 5 658 382 A (LINDBLAD ANDERS) 19 August 1997 (1997-08-19) column 2, line 4 -column 3, line 33; figure 1	1-3,18, 19,24
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Date of the actual completion of the international search

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Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
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Authorized officer

Jelercic, D

## INTERNATIONAL SEARCH REPORT

Internatl Application No  
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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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